FIELD EMITTER ARRAY BASED DICKE SWITCH ARRAY FOR MM-WAVE RADIOMETRIC SYSTEMS

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OBJECTIVE:

The objective of the Phase I program is to build a revolutionary new concept for providing quasi-optical Dicke-switch array that is light weight, has low power consumption, and uses conventional low-cost technology to produce. The quasi-optical switch array is currently being developed for large area displays.

PROGRESS:

During the first month of the Phase I program, the design of the Quasi-optical array has been initiated. Initially the transmission line structure that will form the basis of the switch array is analyzed by using a spectral domain technique. In order to achieve the array operation successfully, the parameters that define the multi-layer structure have been determined. Since the structure of the triode has been established, Figure 1, the multi-layer structure detailed below have been analyzed.

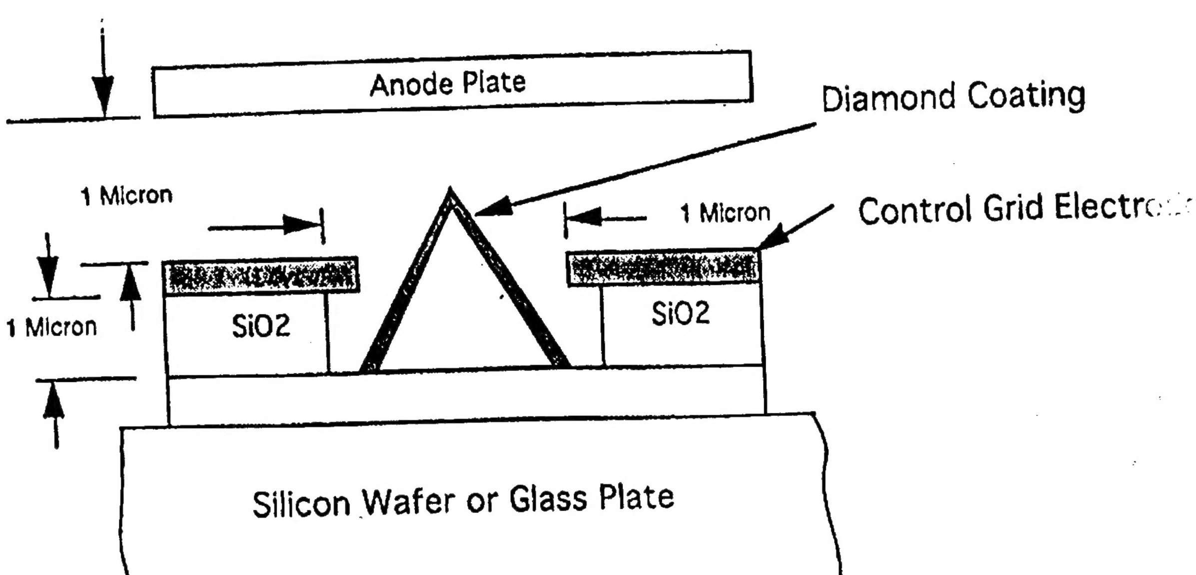


Figure 1 Schematic Diagram of a Micro-fabricated Vacuum Triode

TASK 1: Design Quasi-Optical Array.

The basic dimensions and features of the triode switch have been established as detailed in figure 1. The implementation of the triode into a planar array structure has been simulated by first conducting a spectral domain analysis of the multi-layer transmission medium. The multi-layer structure detailed in figure 2, consist of a thin film transmission lines, on the first glass medium, separated by a vacuum, a second glass medium with triode structure, a third air medium and finally a ground plane. The initial analysis and switch demonstration is aimed for a 50 ohms structure. Once a good correlation is obtained with the measurement, other array impedance can then be designed easily.

Initially, the structure was analyzed for the structure shown in figure 3. This was done to determine the initial parameters. Here the analysis consists of two layers above the conductor and two layers below the conductor. The impedance change with the conductor width change is detailed in figure 4. As shown the impedance of the microstrip type conductor changes from 132 Ohms to 51.76 Ohms by changing the conductor width from 1 cm to 5 cm for constant ground plane spacing of 1 cm.

Then using a more detailed structure, shown is figure 5, further Spectral domain analysis was conducted to determine a structure for a 50 ohm transmission line impedance structure. By introducing the glass structure layers within figure 4 increases the impedance to a higher value. Therefore the height of the ground plane was reduced to a height of 0.5cm for a 48.66 Ohm

impedance. This forms the basic structure to test the switch action in a transmission line. Please note that the height of the ground above the conductor is very high compared to below. It is more practical, for the purpose of determining the switch performance, to consider that the dielectric under the conductor is made of a singlre medium, in this case glass. Since the distance between the anode and cathode is very small, the design can assume that the material, i.e under the microstrip conductor is uniform and homogenous. The 50 ohm transmisssion line width changes with the dielectric thickness at 30 Ghz as shown in Figure 6. For the purpose of testing the switching we will utilize a 60 mil wide line with the triode structure in the mid point. of the dielectric. This switch will be fabricated and tested. Once the switch performance is evaluated, the array design will commence and array analysis will be conducted with more confidence.

Plans for Next Month:

During the next month the fabrication and test of the triode switch in a transmission line will be conducted and the design of the array will be conducted.

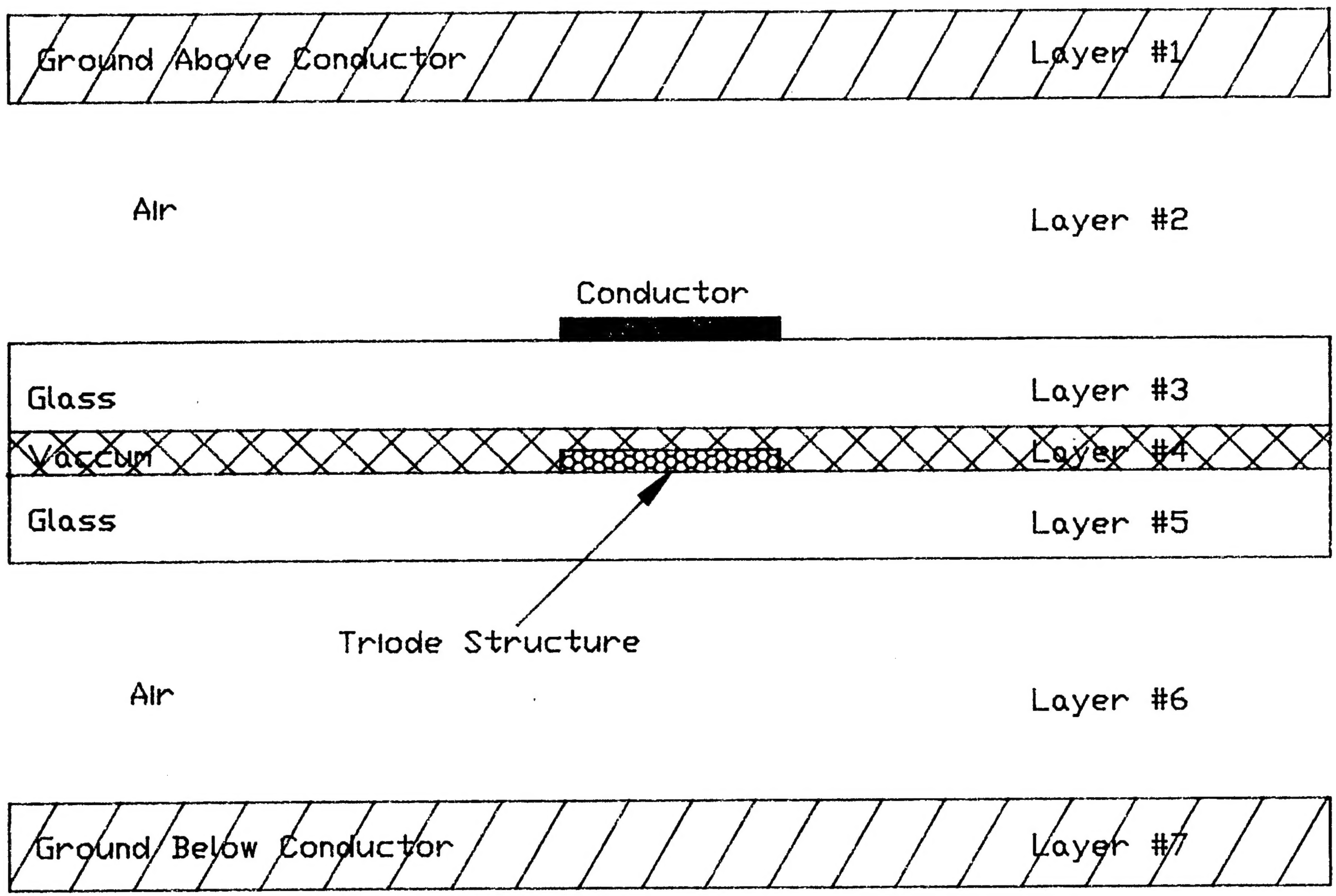


FIGURE 2: Multi-Layer Structure for Analysis

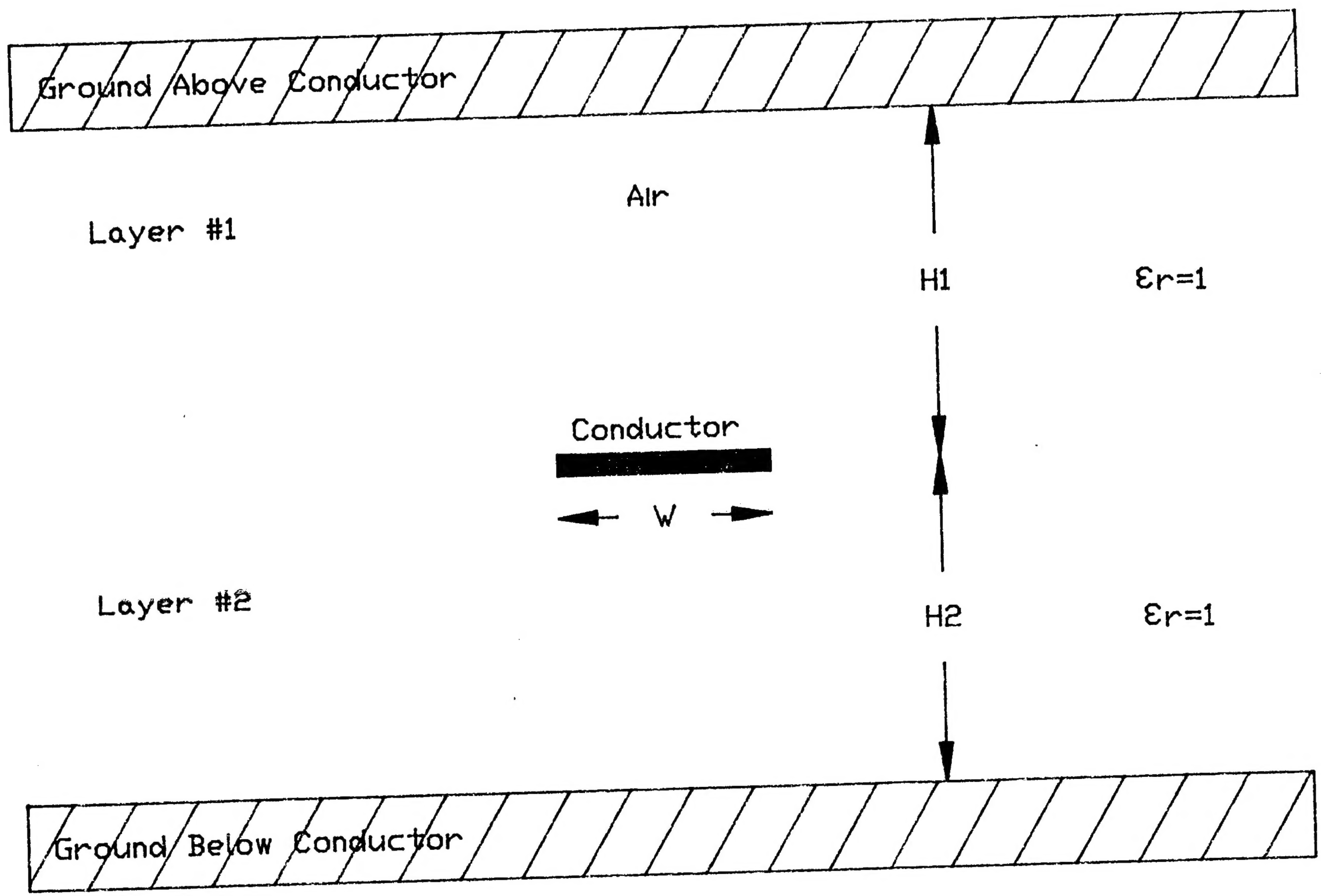
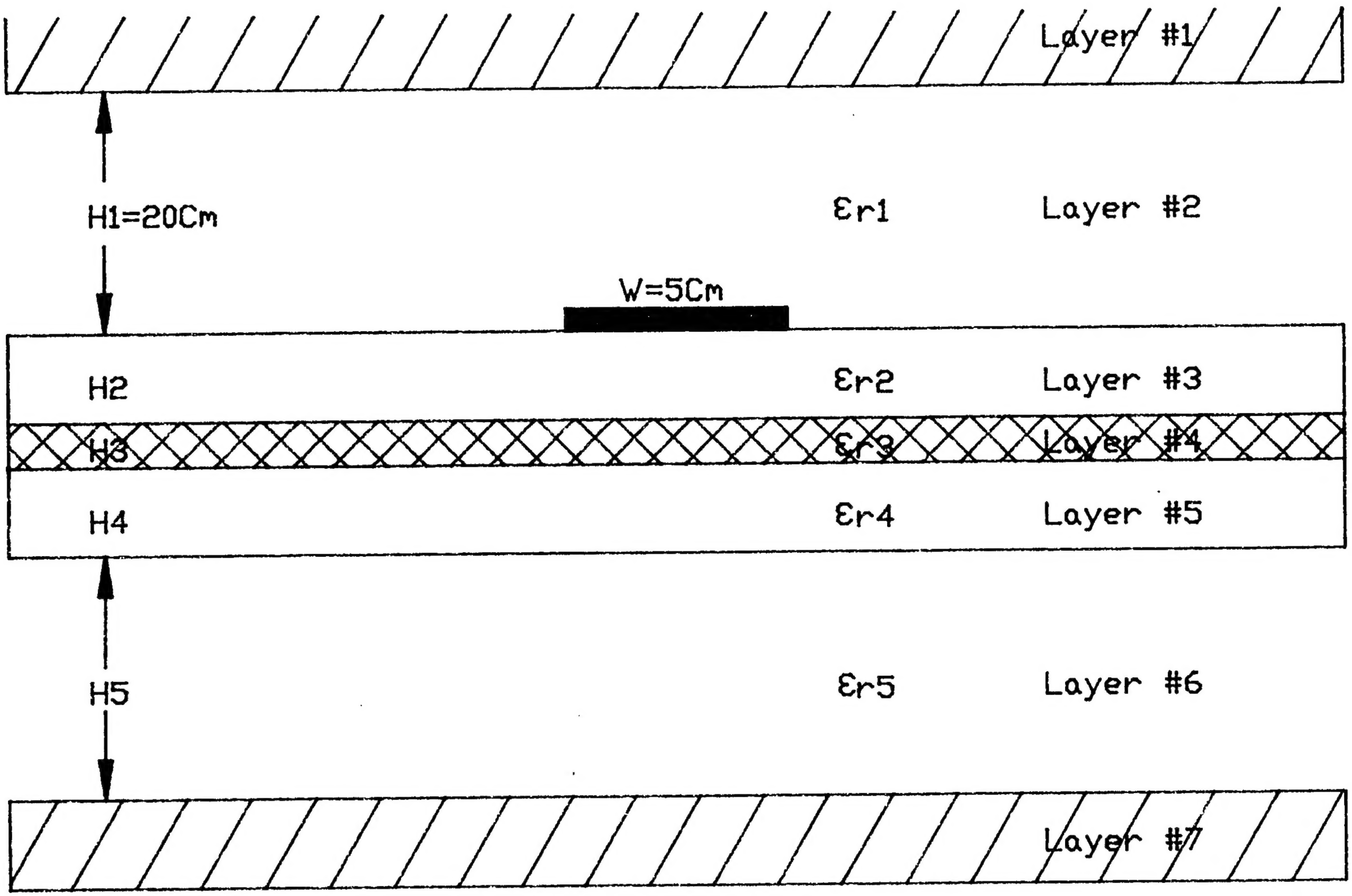


FIGURE 3: Initial Analysis Structure

W(Cm)	H1(Cm)	H2(Cm)	Z(ohms)
1	20	1	132.00
2	20	1	94.00
3	20	1	73.00
4	20	1	60.73
5	20	1	51.76

FIGURE 4: Impedance vs. width for Fig. 3

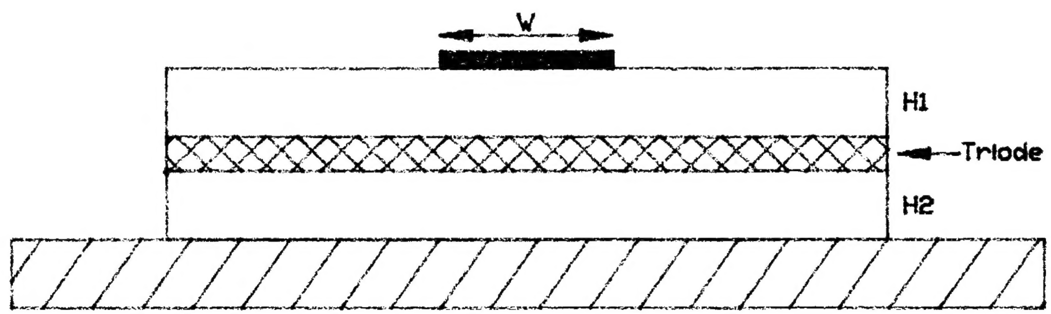


H1=20 Cm, H2=.25mm, H3=.001mm, H4=.25mm, H5=.5mm

Z=48.61 ohms

Layer #4 will constitute the triode layer

FIGURE 5: Impedance of Multi-Layer Structure



f=30GHz

H1 (mils)	H2 (mils)	H1+H2 (mils)	W (mils)	Z0 (ohms)	Keff
50	50	100	230	50	3.84
40	40	80	179.6	50	3.79
30	30	60	130	50	3.70
25	25	50	105	50	3.63
15	15	30	60	50	3.41

FIGURE 6